

SUMMARY OF THE INVENTION

The present invention relates to an adhesive and more particularly to a moisture curable adhesive. The present invention is further directed to a method of joining two adherends.

5 In one embodiment, the present invention includes a moisture curable adhesive comprising a polymer or copolymer including reactive silicon end groups; from about 0.1 to about 40 percent by weight of a clear filler that will not substantially interfere with the clarity of the adhesive; and from about 0.01 to about 10 percent by weight of a dehydrating agent.

10 In another embodiment, the present invention includes a moisture curable adhesive comprising a polymer or copolymer including reactive silicon end groups; from about 33 to about 85 percent by weight of a filler; and from about 0.01 to about 10 percent by weight of a dehydrating agent.

In another embodiment, the present invention includes a method of joining at least two adherends comprising the steps of applying a layer of from about 1.1 mm to about 7 mm of moisture curable adhesive comprising a polymer or copolymer including reactive silicon end groups to at least one adherend of two adherends; maintaining the two adherends in non-contact with each other until the adhesive begins to develop a sufficient tack to hold the at least two adherends together; and 20 first contacting and then forming a bond between the two adherends with the adhesive.

In still another embodiment, the present invention includes a method of joining at least two adherends comprising the steps of applying a layer of moisture curable adhesive comprising a polymer or copolymer including reactive silicon end groups to at least one adherend of two adherends; maintaining the two adherends in non-contact with each other for less than about 20 minutes until the adhesive begins to develop a sufficient tack to hold the at least two adherends together; and first contacting then forming a bond between the two adherends with the adhesive wherein the two adherends can be repositioned after contacting and the adhesive reaches an initial cure in less than thirty minutes.

Afterwards, 12.5 grams (1.34 weight percent) of dibutyl tin oxide in diisooctyl phthalate catalyst sold under the tradename FomRez SUL-11A by Witco OSI Specialties of Danbury, CT was added to the mixture, a vacuum was drawn and the mixture was mixed at low speed for 5 minutes. The mixture was then transferred to 5 air-tight containers for further testing.

Example 3

A clear adhesive was made by mixing 760.0 grams (76.3 weight percent) of a polypropyleneoxide with a methyldimethoxysilyl functional group sold under the tradename MS Polymer MAX 601 by Kaneka of Osaka, Japan in a low speed Sigma 10 Blade Lab Mixer from Teledyne Readco of York, PA keeping the mixer covered to minimize moisture pickup. The Sigma Blade Lab Mixer was started on a low speed and the following were added: 150 grams (15.1 weight percent) of fumed amorphous silica filler with a surface area of 50 m²/gram sold under the tradename Aerosil OX-50 by Degussa Corporation of Ridgefield Park, NJ; 15.0 grams (1.51 weight percent) 15 of fumed amorphous silica filler with a surface area of 110 m²/gram sold under the tradename Aerosil R972 by Degussa Corporation of Ridgefield Park, NJ; 6.0 grams (0.60 weight percent) of a substituted benzotriazole anti-oxidant sold under the tradename of Tinuvin 327 by Ciba Specialty Chemicals of Tarrytown, NY; 6.0 grams (0.60 weight percent) of a hindered amine light stabilizer anti-oxidant sold under the 20 tradename of Tinuvin 770 by Ciba Specialty Chemicals of Tarrytown, NY; and 6.0 grams (0.60 weight percent) of a sterically hindered phenolic anti-oxidant sold under the tradename Irganox 1010 by Ciba Specialty Chemicals of Tarrytown, NY. The mixer was then sealed and heated to between 71-77 °C. While heating a vacuum was pulled on the mixer to continuously distill off any water in the mixture. The mixture 25 was tested after reaching the target temperature to determine whether the target moisture level of less than 1000 ppm was obtained. The heating and vacuum were continued until this target was achieved. Once attained, the heat was shut off and the vacuum broken. Once the batch had cooled to less than 50°C, then 15.2 grams (1.52 weight percent) of a vinyl trimethoxysilane dehydrating agent sold under the 30 tradename Silquest A-171 Silane by Witco OSI Specialties of Danbury, CT was added to the mixture and mixed at low speed for 5 minutes. Afterwards, 22.8 grams

(2.29 weight percent) of N-(3-trimethoxy-1,2-ethanediamine) silane adhesion promoter sold under the tradename Silquest A-2120 by Witco OSI Specialties of Danbury, CT was added to the mixture and mixed at low speed for 5 minutes. Afterwards, 15.2 grams (1.53 weight percent) of dibutyl tin oxide in diisooctyl phthalate catalyst sold under the tradename FomRez SUL-11A by Witco OSI Specialties of Danbury, CT was added to the mixture, a vacuum was drawn and the mixture was mixed at low speed for 5 minutes. The mixture was then transferred to air-tight containers for further testing.

Example 4

10 A clear adhesive was made by mixing 689.0 grams (70.3 weight percent) of a polypropyleneoxide with a methyldimethoxysilyl functional group sold under the tradename MS Polymer MAX 601 by Kaneka of Osaka, Japan in a low speed Sigma Blade Lab Mixer from Teledyne Readco of York, PA keeping the mixer covered to minimize moisture pickup. The Sigma Blade Lab Mixer was started on a low speed
15 and the following were added: 204.0 grams (20.8 weight percent) of fumed amorphous silica filler with a surface area of 50 m²/gram sold under the tradename Aerosil OX-50 by Degussa Corporation of Ridgefield Park, NJ; 13.6 grams (1.39 weight percent) of fumed amorphous silica filler with a surface area of 110 m²/gram sold under the tradename Aerosil R972 by Degussa Corporation of Ridgefield Park,
20 NJ; 5.4 grams (0.55 weight percent) of a substituted benzotriazole anti-oxidant sold under the tradename of Tinuvin 327 by Ciba Specialty Chemicals of Tarrytown, NY; 5.4 grams (0.55 weight percent) of a hindered amine light stabilizer anti-oxidant sold under the tradename of Tinuvin 770 by Ciba Specialty Chemicals of Tarrytown, NY; and 5.4 grams (0.55 weight percent) of a sterically hindered phenolic anti-oxidant sold
25 under the tradename Irganox 1010 by Ciba Specialty Chemicals of Tarrytown, NY. The mixer was then sealed and heated to between 71-77 °C. While heating a vacuum was pulled on the mixer to continuously distill off any water in the mixture. The mixture was tested after reaching the target temperature to determine whether the target moisture level of less than 1000 ppm was obtained. The heating and vacuum
30 were continued until this target was achieved. Once attained, the heat was shut off and the vacuum broken. Once the batch had cooled to less than 50°C, then 13.8

broken. Once the batch had cooled to less than 50°C, then 15.2 grams (1.70 weight percent) of a vinyl trimethoxysilane dehydrating agent sold under the tradename Silquest A-171 Silane by Witco OSI Specialties of Danbury, CT was added to the mixture and mixed at low speed for 5 minutes. Afterwards, 22.8 grams (2.55 weight percent) of N-(3-trimethoxy-1,2-ethanediamine) silane adhesion promoter sold under the tradename Silquest A-1120 by Witco OSI Specialties of Danbury, CT was added to the mixture and mixed at low speed for 5 minutes. Afterwards, 15.2 grams (1.70 weight percent) of dibutyl tin oxide in diisoctyl phthalate catalyst sold under the tradename FomRez SUL-11A by Witco OSI Specialties of Danbury, CT was added to the mixture, a vacuum was drawn and the mixture was mixed at low speed for 5 minutes. The mixture was then transferred to air-tight containers for further testing.

Example 6

A white adhesive was made by mixing 400.0 grams (31.5 weight percent) of a polypropyleneoxide with a methyldimethoxysilyl functional group sold under the tradename MS Polymer S303H by Kaneka of Osaka, Japan in a low speed Sigma Blade Lab Mixer from Teledyne Readco of York, PA keeping the mixer covered to minimize moisture pickup. The Sigma Blade Lab Mixer was started on a low speed and the following were added: 220.0 grams (17.3 weight percent) of butyl benzyl phthalate sold under the tradename Santicizer 160 by Solutia, Inc. of St. Louis, MO; 550.0 grams (43.3 weight percent) of calcium carbonate sold under the tradename Wingdale White by Imerys of Roswell, GA; 50.0 grams (3.93 weight percent) of titanium dioxide whitener sold under the tradename Tiona RCL-9 by Millenium Inorganic Chemicals Inc. of Baltimore, MD; 20.0 grams (1.57 weight percent) of fumed amorphous silica filler with a surface area of 200 m²/gram sold under the tradename Aerosil 200 by Degussa Corporation of Ridgefield Park, NJ; 3.0 grams (0.24 weight percent) of a substituted benzotriazole anti-oxidant sold under the tradename of Tinuvin 327 by Ciba Specialty Chemicals of Tarrytown, NY; 3.0 grams (0.24 weight percent) of a hindered amine light stabilizer anti-oxidant sold under the tradename of Tinuvin P by Ciba Specialty Chemicals of Tarrytown, NY; and 3.0 grams (0.24 weight percent) of a sterically hindered phenolic anti-oxidant sold under the tradename Irganox 1010 by Ciba Specialty Chemicals of Tarrytown, NY. The